

Mars Lander 2007



DEPARTMENT OF PLANETARY SCIENCES  
LUNAR AND PLANETARY LABORATORY  
UNIVERSITY OF ARIZONA, TUCSON, AZ

# The Phoenix Mars Mission

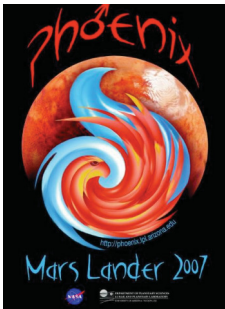
Leslie K. Tamppari,  
Project Scientist  
Jet Propulsion  
Laboratory/Caltech

Peter H. Smith, University of  
Arizona

And the Phoenix Science Team

Polar Gateways Conference  
January 29, 2008





# Odyssey Gamma Ray Subsystem sees ice within the top meter of the surface (July 2002)



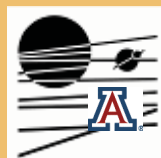
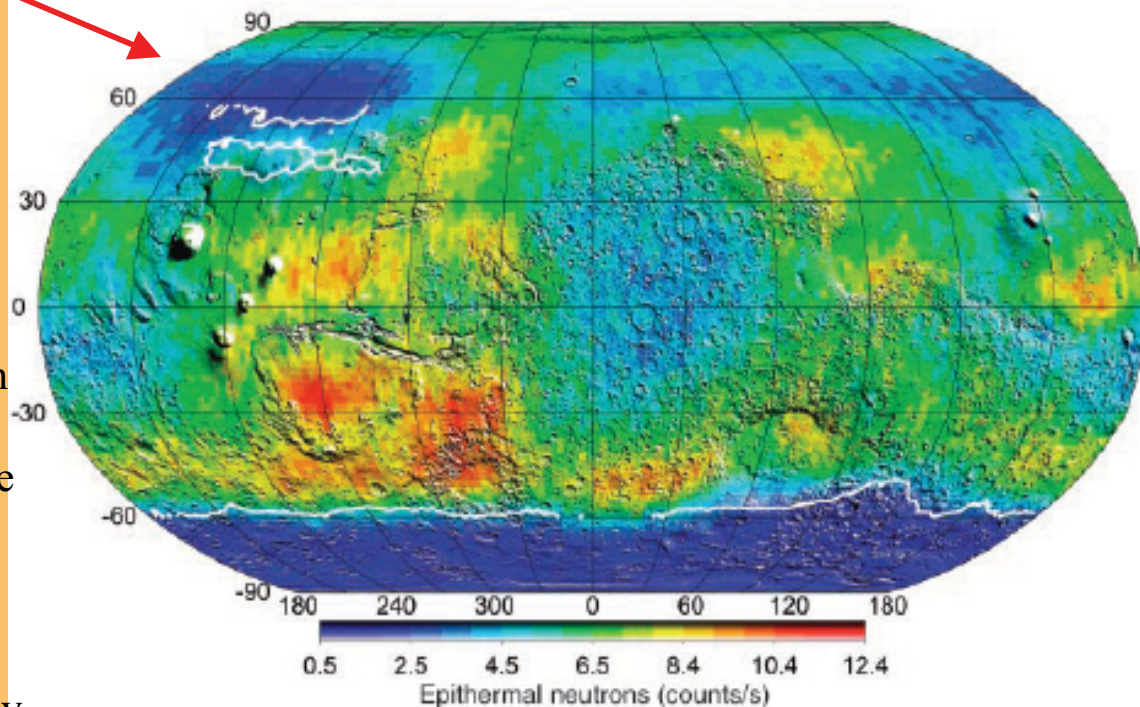
Models predict ice;  
Dark blue signal shows  
high H content

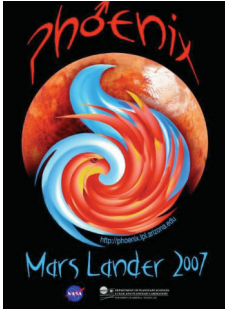
## Goal #1: Study the history of and current state of water

- Was there past standing water?
- Does unfrozen water exist?
- What processes shape the surface?
- What is the amount and state of water in the atmosphere?
- How much water is in the surface vs. the atmosphere?

## Goal #2: Search for habitable zones (not life detection)

- Are there organics in the soil and do they vary with depth?
- Are there other biogenic elements?
- Can unfrozen water layers exist?
- Is the soil acidic or basic?

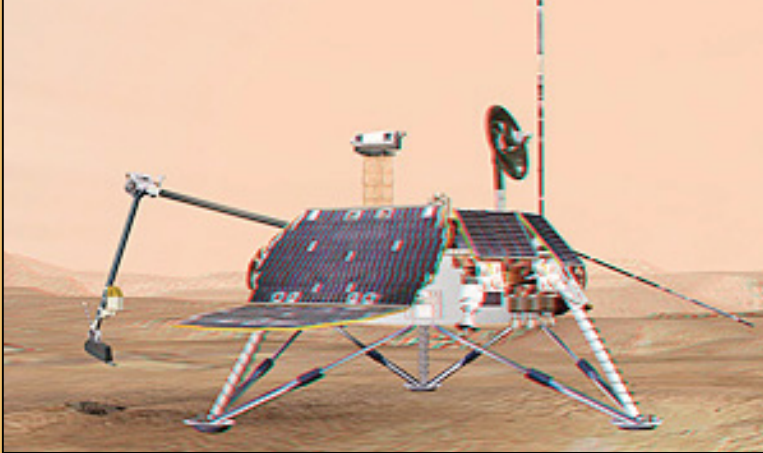




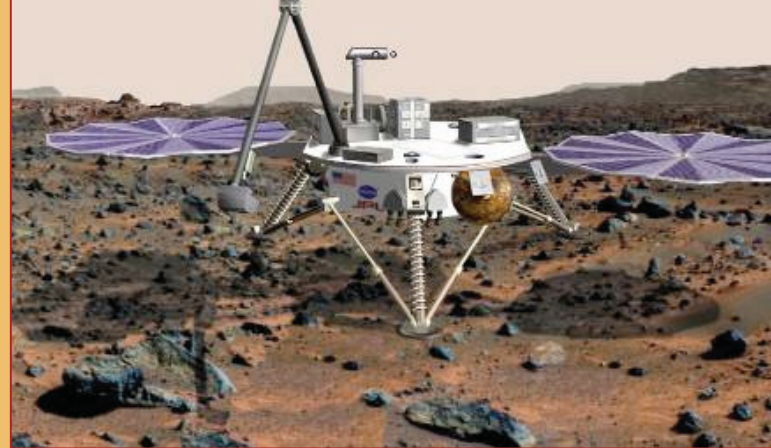
# Phoenix: Reborn from 2 previous spacecraft



1998 Mars Polar Lander



2001 Mars Lander Spacecraft



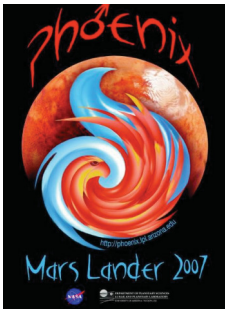
Phoenix



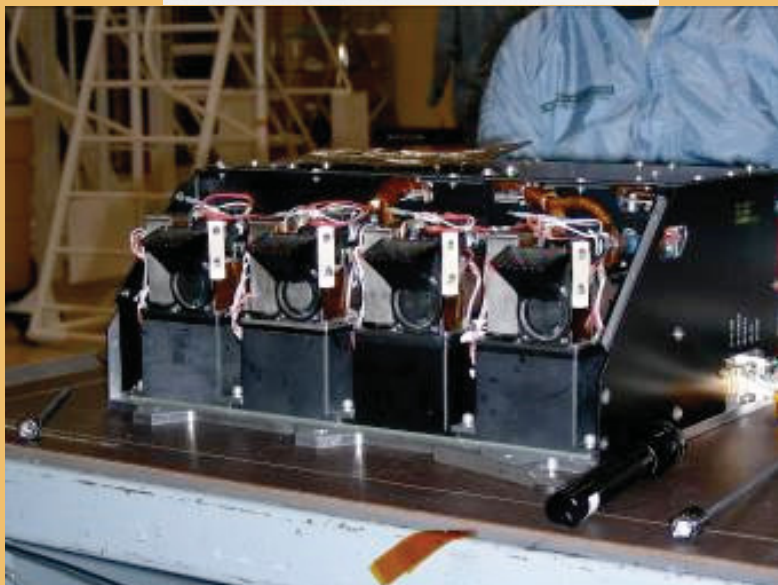
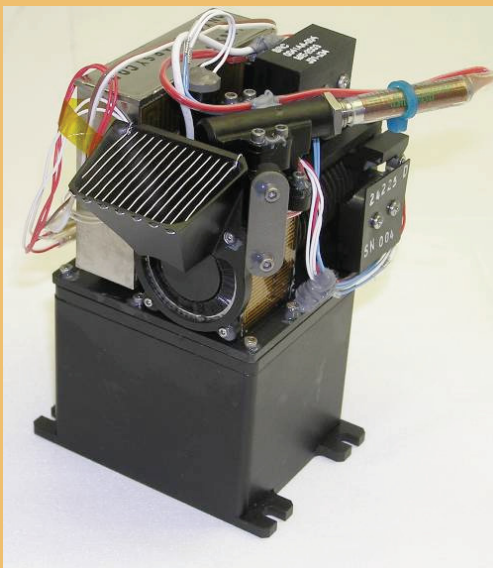


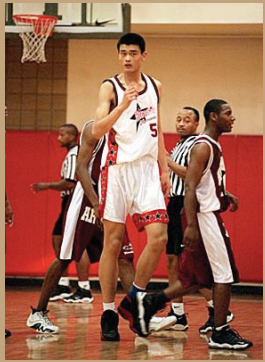
MECA: wet chemistry

TEGA

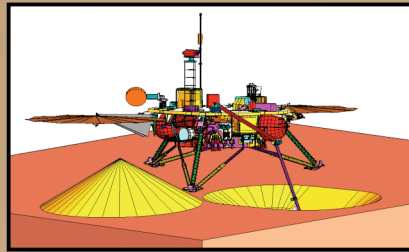


# MECA Wet Chemistry and the Thermal and Evolved-gas Analyzer (TEGA)





Yao Ming (7'6")

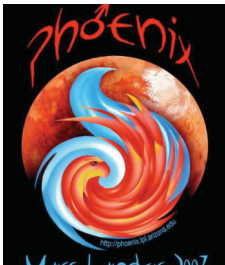


2.35m (7'7")

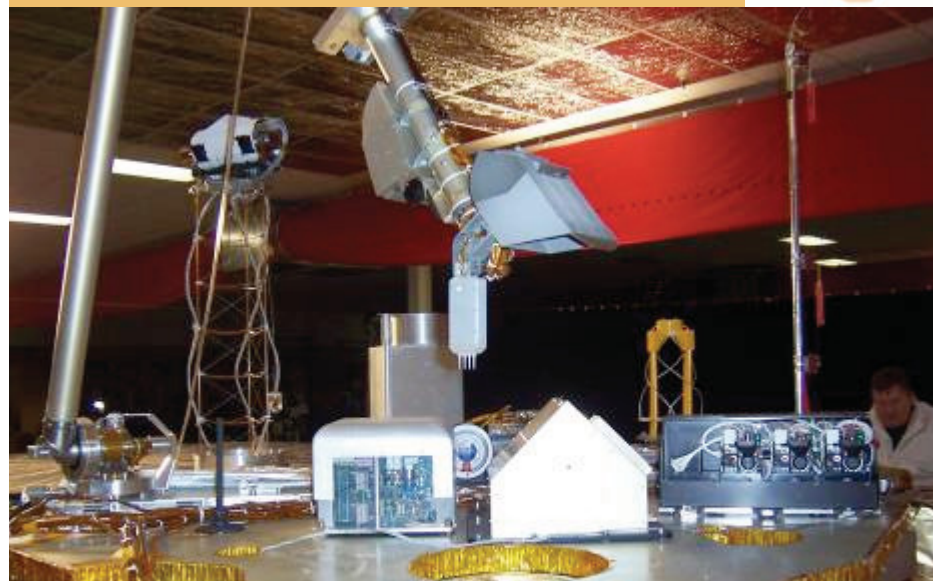
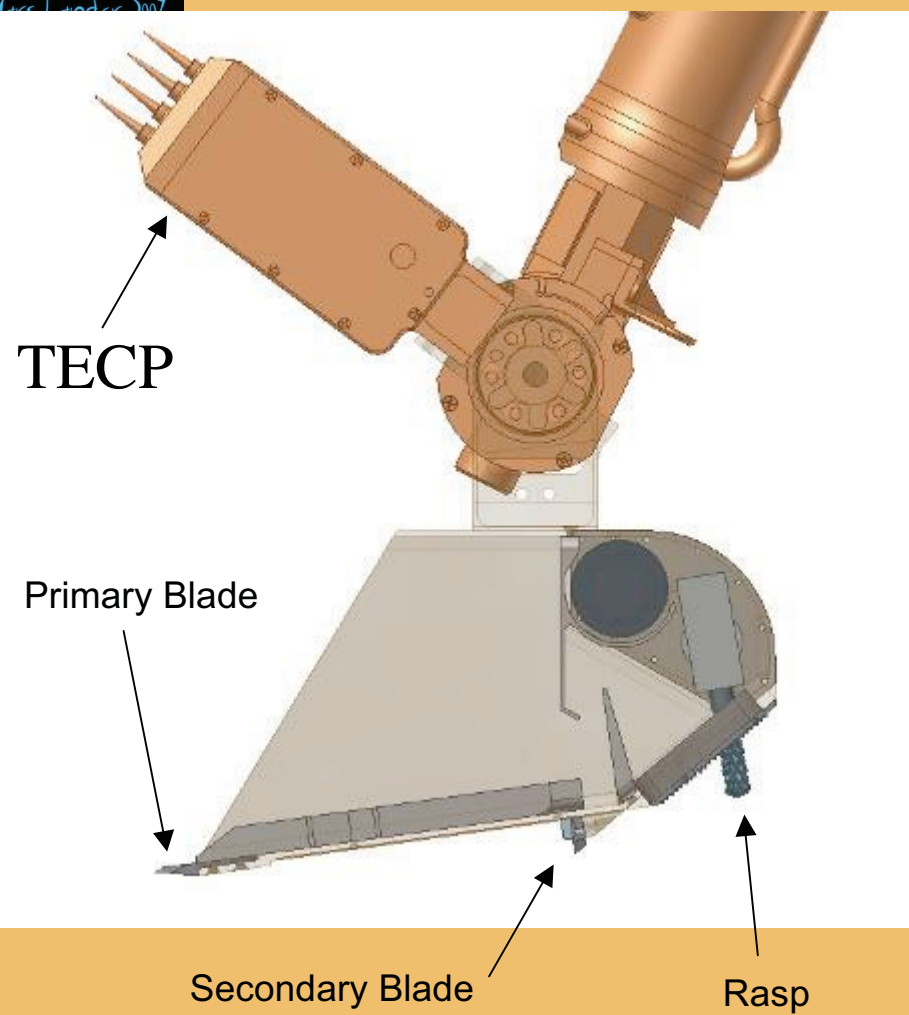
Robotic Arm:  
ice tool, scraper blades,  
scoop

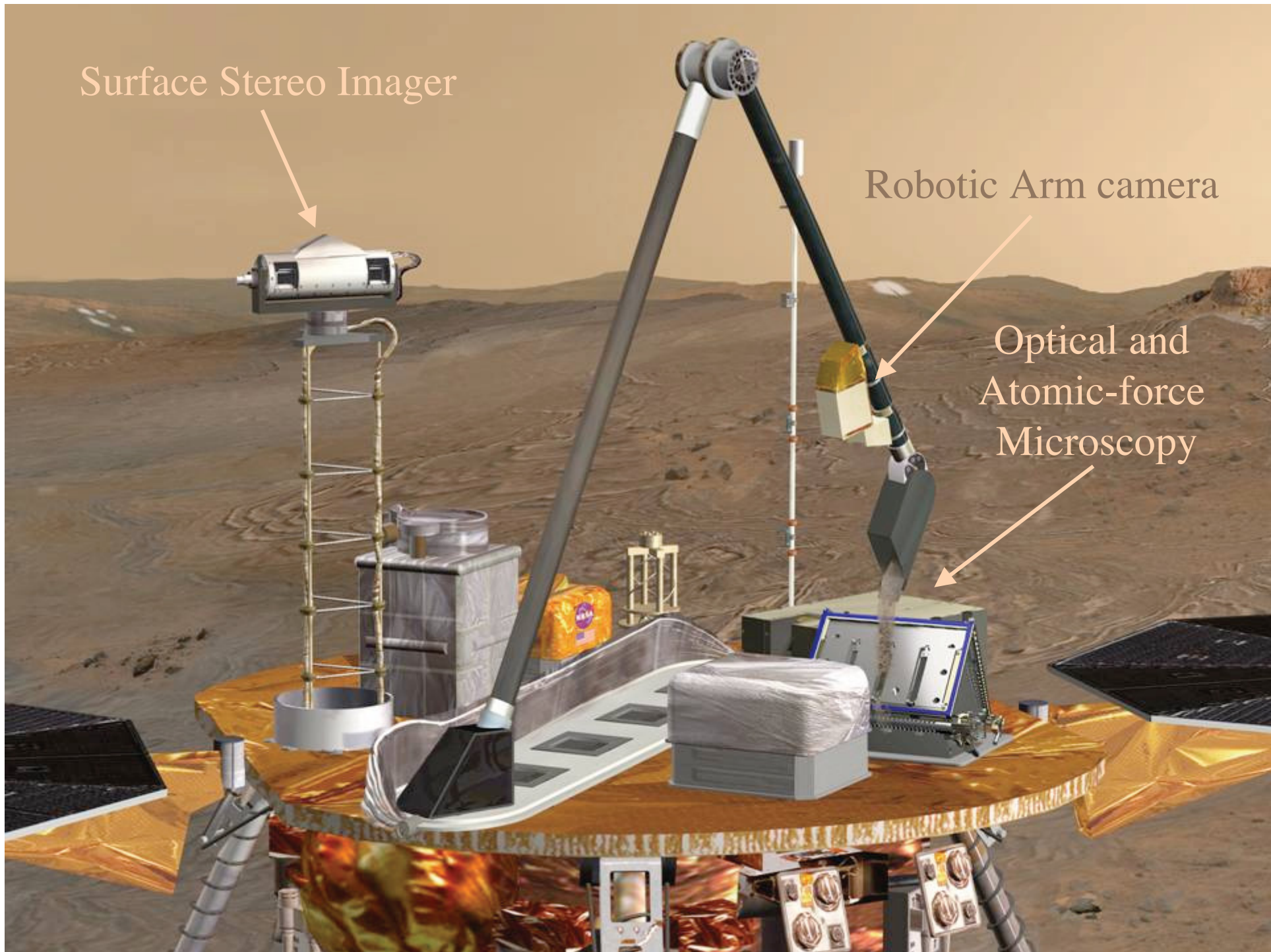
Thermal and  
electrical  
conductivity  
probe





# Ice acquisition tools

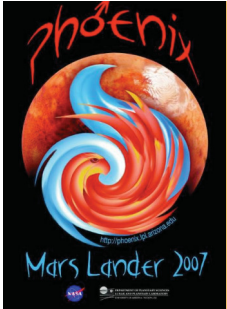




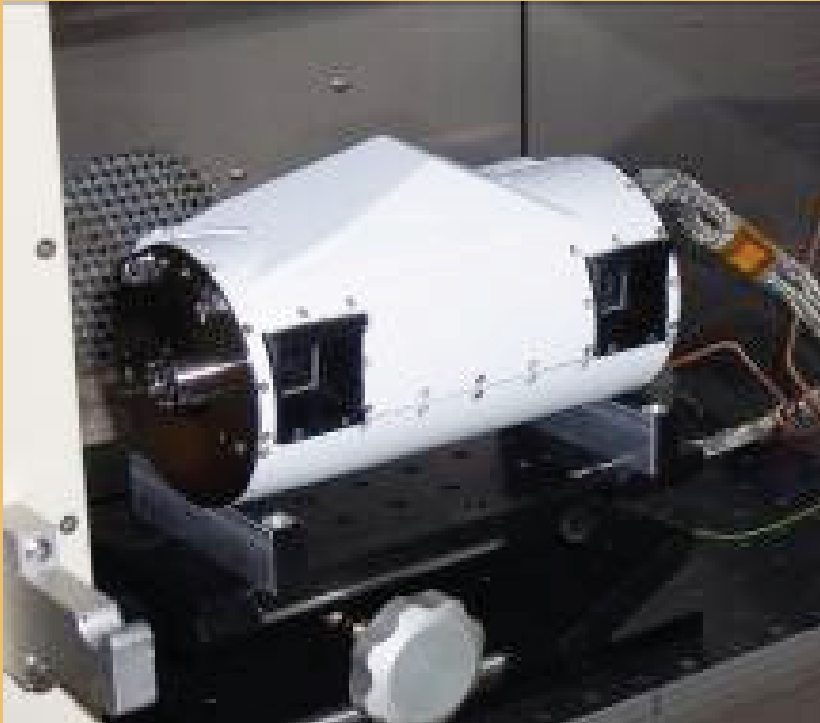
Surface Stereo Imager

Robotic Arm camera

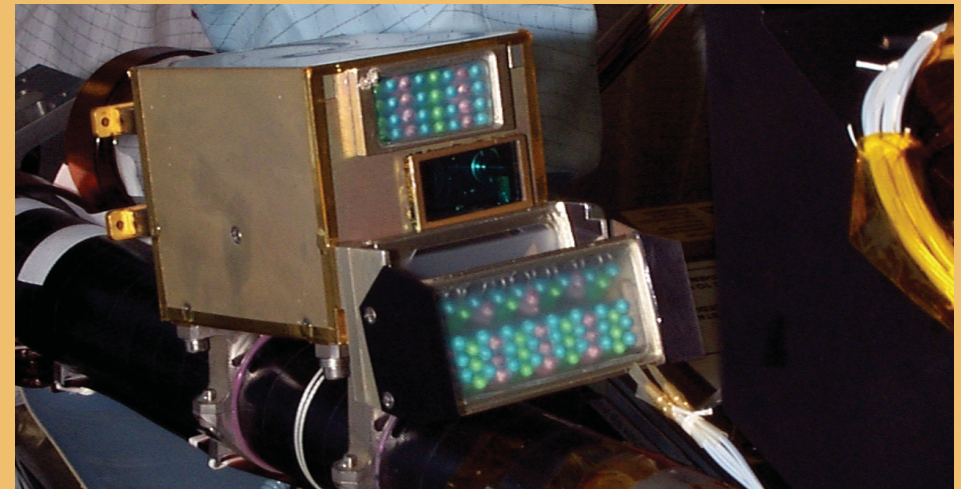
Optical and  
Atomic-force  
Microscopy



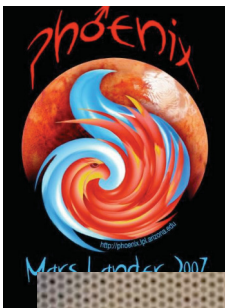
# Imaging at multiple scales



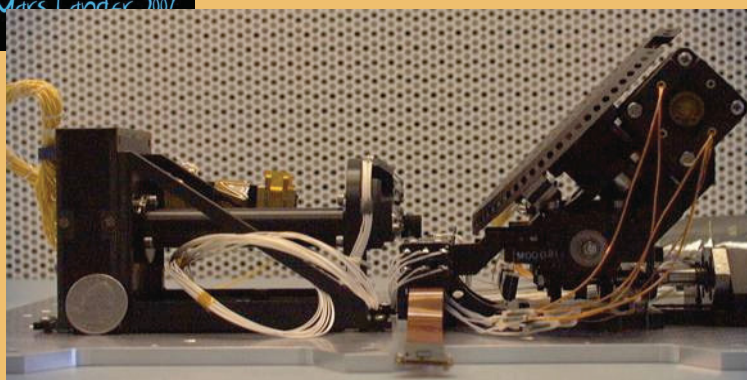
- Panoramic color/stereo imager can see trench layers or particles as small as 2 mm



- Robotic arm camera can see scoop particles as small as 0.5 mm



# Microscopy station (0.1-2000 $\mu\text{m}$ resolution)



30 cm

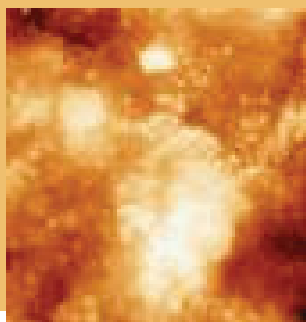
**Microscopes and sample wheel**



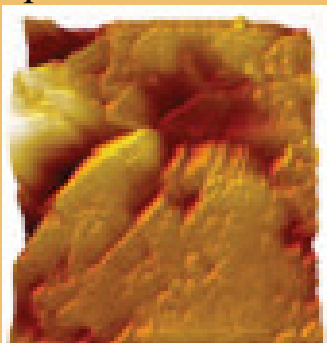
1 mm

*This optical microscope image particles is a composite of 3 pictures taken under red, green, and blue illumination*

AFM on sand exposed  
to aeolian and aqueous erosion

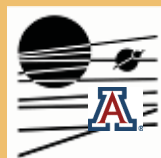
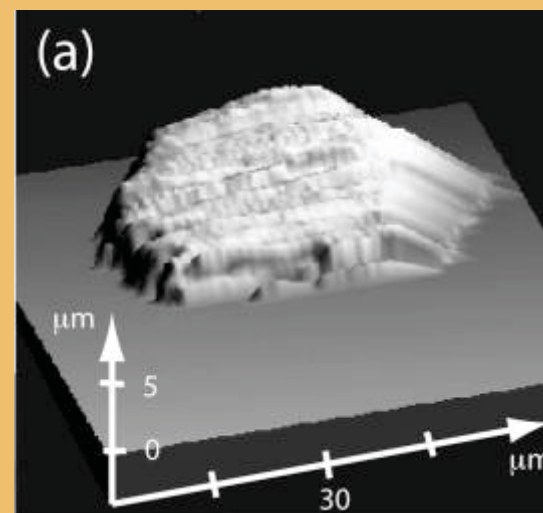


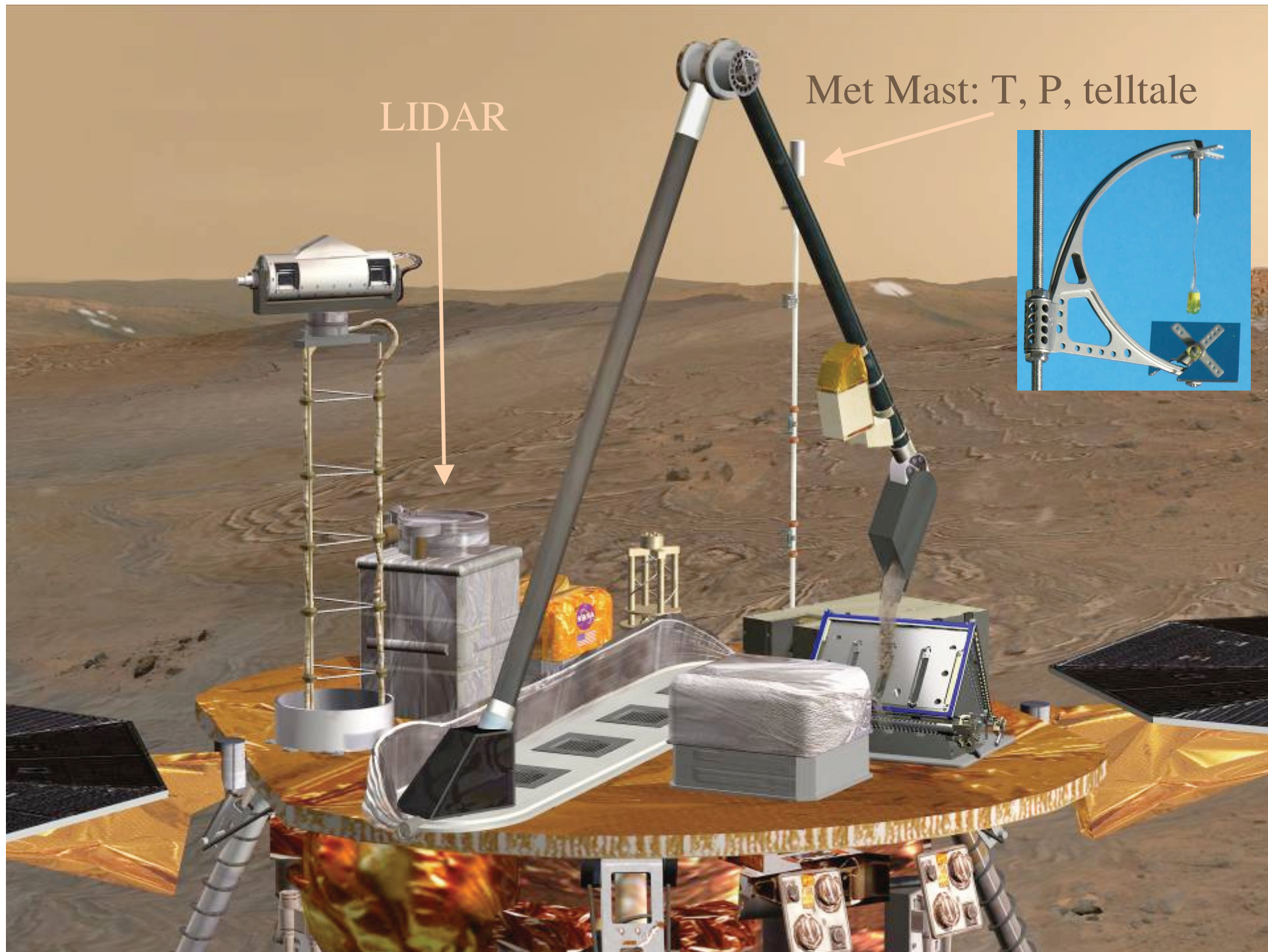
aeolian erosion



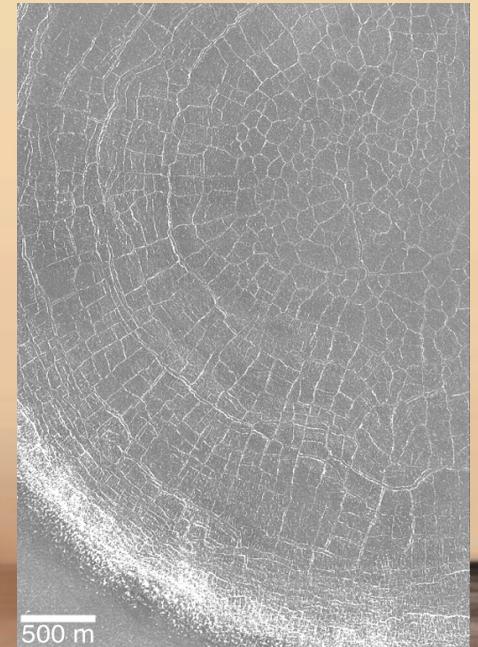
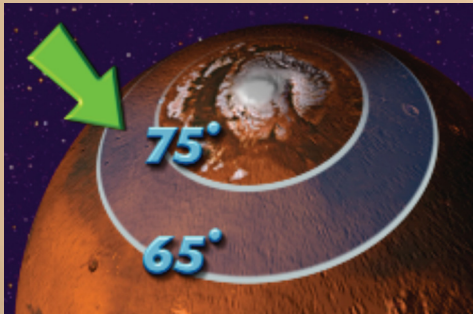
aqueous erosion

AFM on ice  
crystal on  
mica





# Where is the best place to land?

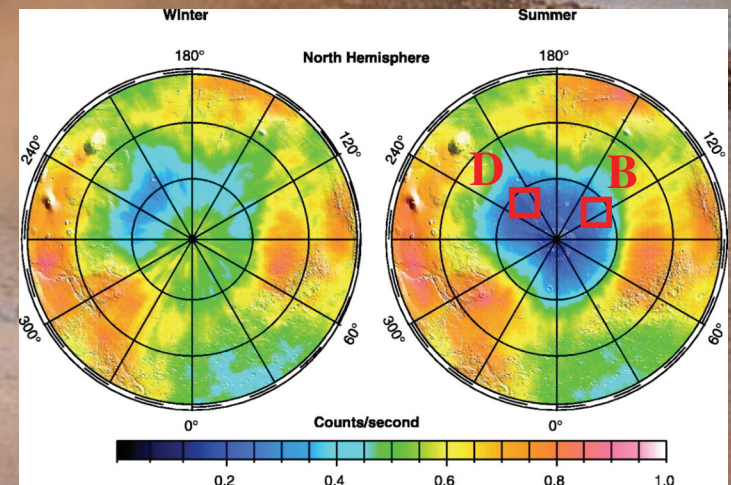


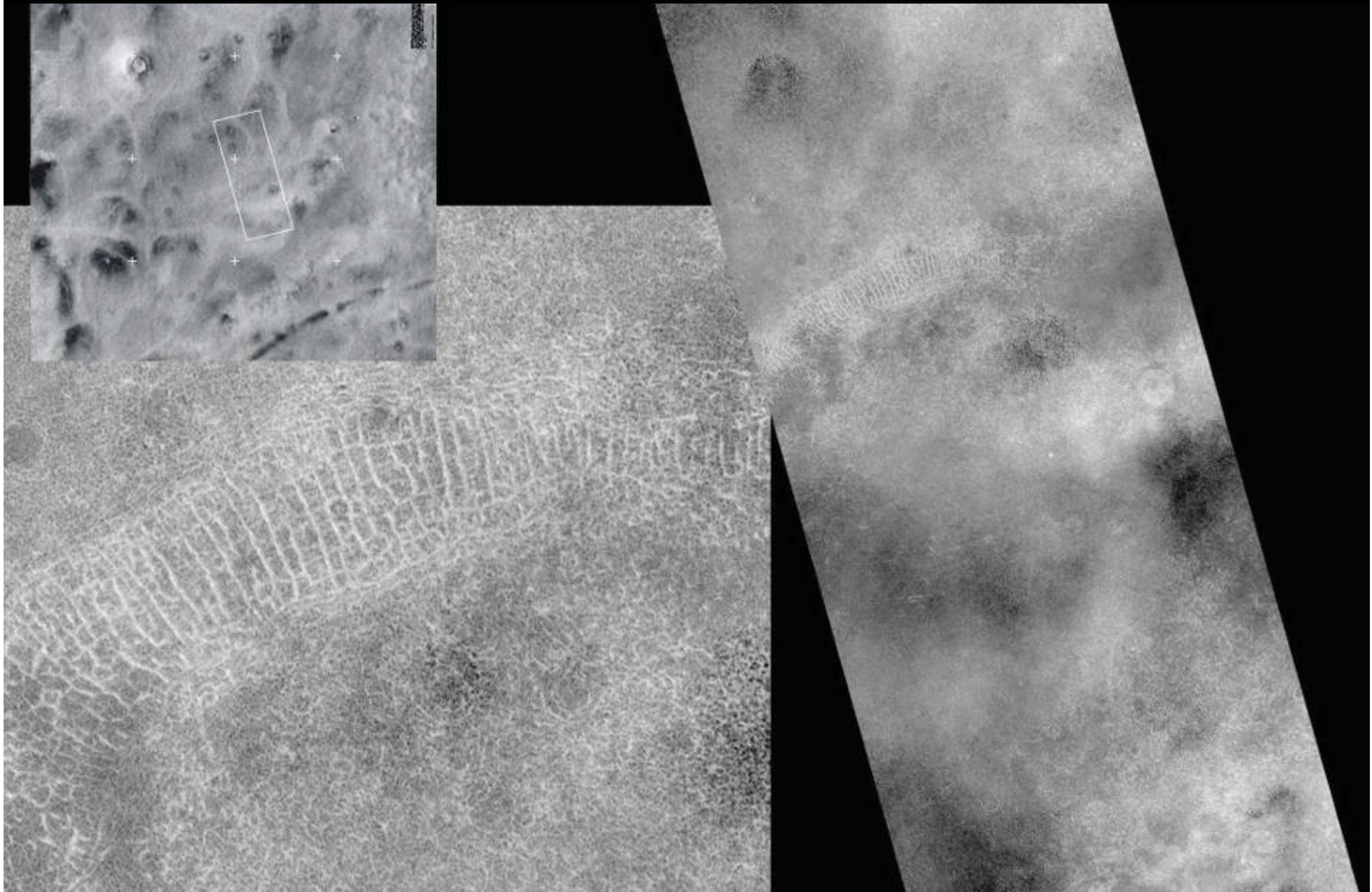
## • Science

- Access to ice
- Evidence for ice processes
- Latitude:  $65^{\circ}$  -  $72^{\circ}$  N

## • Safety

- Elevation:  $< -3500$  m
- Slopes:  $< 16^{\circ}$
- Small amount of large rocks
  - 35 cm high rock is damaging
- No large hazards (craters)
- Ellipse  $\sim 150 \times 30$  km (100x20 mi)







**To: Peter and the Phoenix Team**

**Happy Halloween!!**

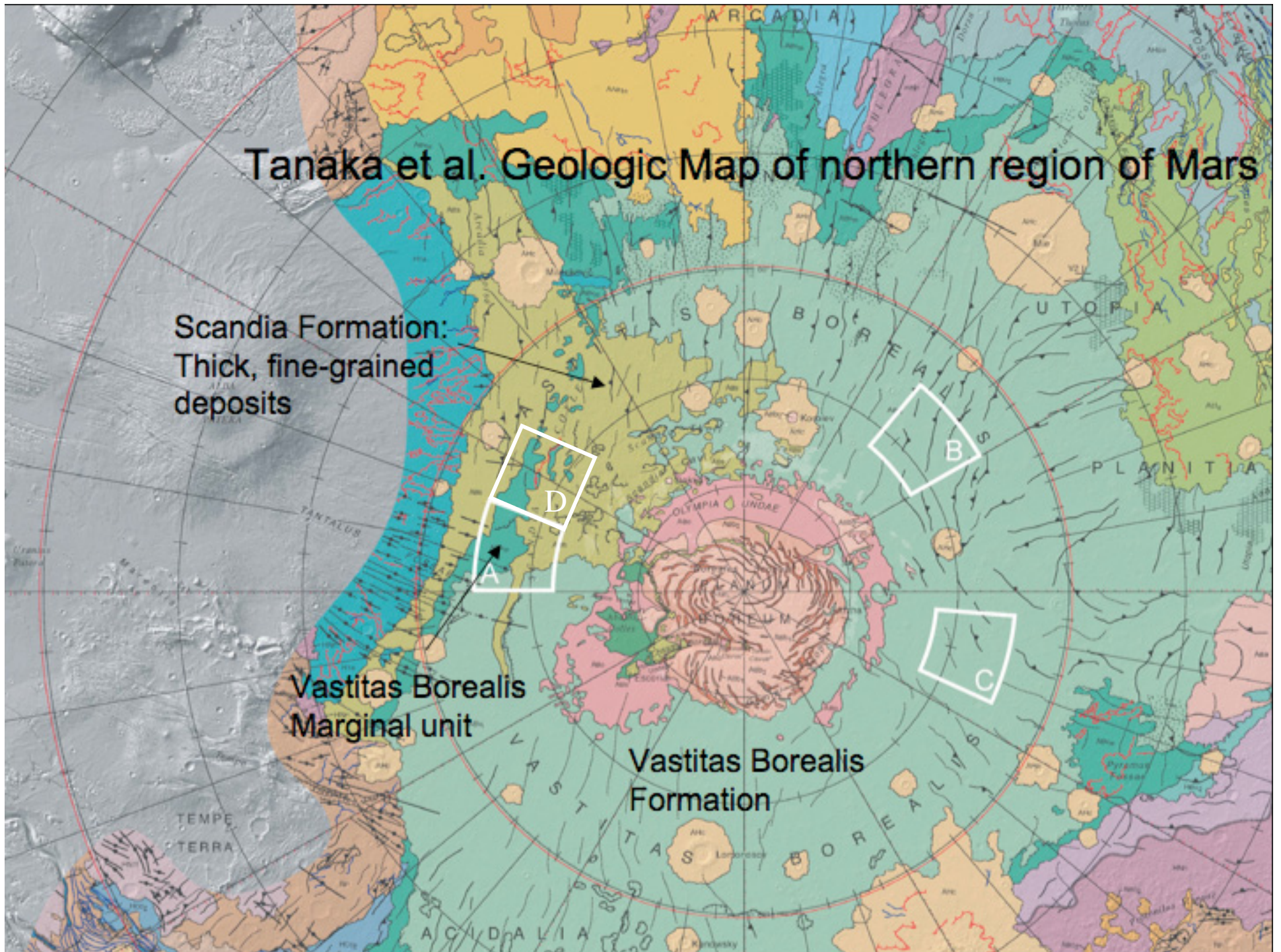
**From Alfred and the HiRISE Team**

# Tanaka et al. Geologic Map of northern region of Mars

Scandia Formation:  
Thick, fine-grained  
deposits

Vastitas Borealis  
Marginal unit

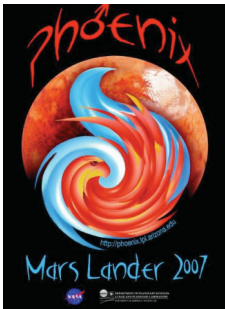
Vastitas Borealis  
Formation



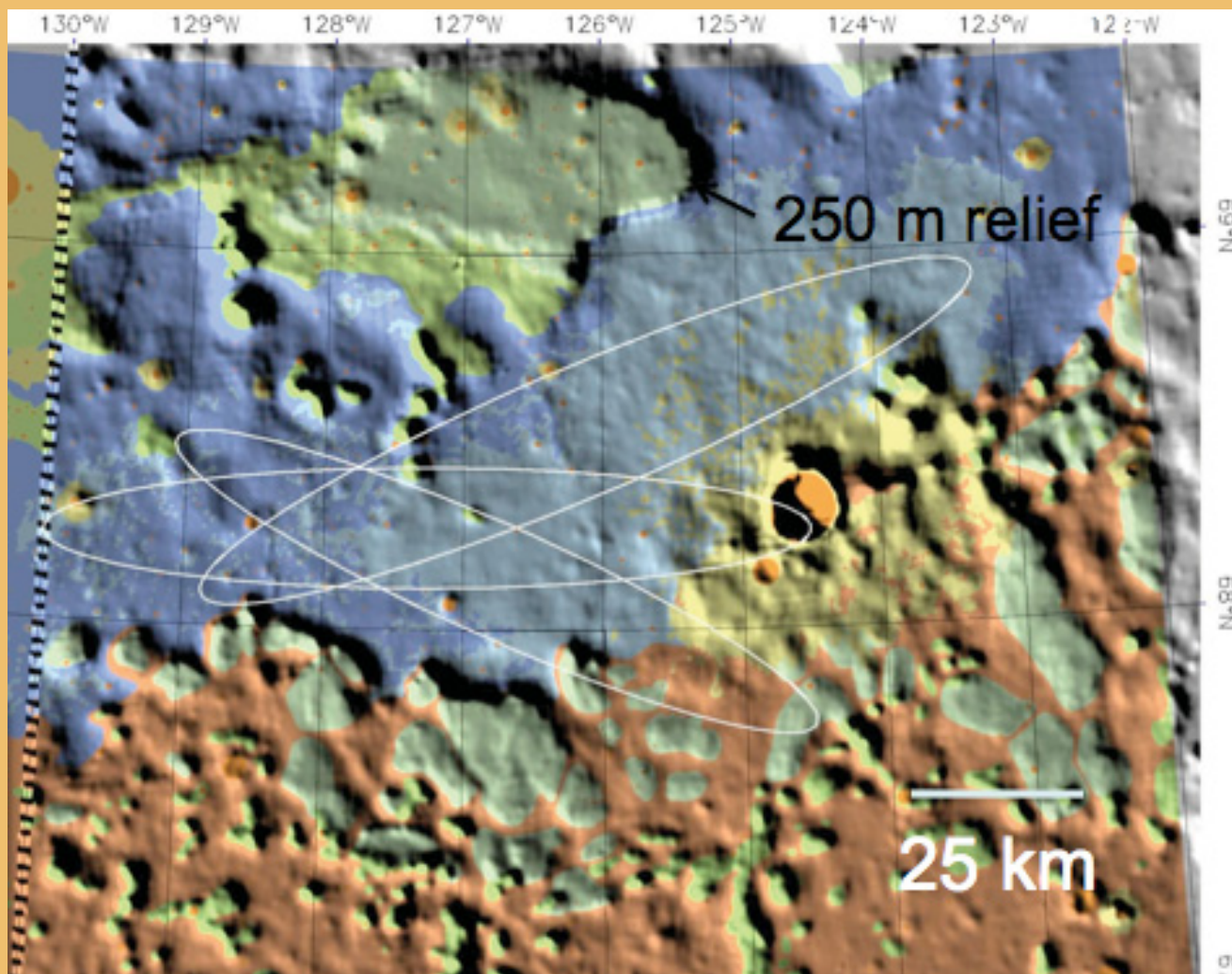
To Peter and the Phoenix Team:

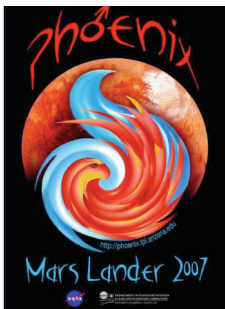
**Happy New Year 2007!**

From Alfred and the HiRISE Team



# The Valley of Safety





# What might the surface look like? The Antarctic Dry Valleys?



M. Mellon



**Phoenix will make significant steps forward in our understanding  
of the history of water and the habitability potential  
of the north polar region of Mars**



<http://phoenix.lpl.arizona.edu>